

# Going Beyond Poor/Non-Poor Comparisons in Studying Oral Health Inequalities.

(T.F. Drury and J.G. Corrigan\*, National Institute of Dental and Craniofacial Research, NIH, USA)

## Introduction

### Background

National health policy focuses increasingly on the identification and reduction of health inequalities (see Health: United States, 1998 and Healthy People: 2010). Major types of health inequalities occur among economic categories of the population. Since poor/non-poor comparisons are frequently used to quantify economic disparities both in health and in the utilization of health services, it is important to consider what poor/non-poor comparisons can tell us, as well as what such comparisons may not be telling us, about health inequalities. Current concerns with identifying the largest inequalities and with focusing policy on closing the largest gaps gives such considerations a timely poignancy.

### Objective

The purpose of the present study was to evaluate potential information biases in poor/non-poor comparisons of oral health which may stem from overlooking diversity among both the poor and the non-poor.

### Scope

Towards this end, attention focused on three indicators. Two of them were indicators reflective of unmet oral health needs: edentulism and the presence of any untreated tooth decay in the permanent dentition. The third focused on access to oral health care as indicated by a recent visit to a dentist or dental hygienist.

### Definitions:

- **Edentulism:** Person was missing all of their natural teeth.
- **Any Untreated Tooth Decay in the Permanent Dentition:** Person had one or more coronal tooth surfaces with untreated decay, or had one or more root tooth surfaces with untreated decay, or had both types of untreated decay.
- **A Recent Dental Visit:** Person reported having visited a dentist or dental hygienist in the 12-month period preceding their NHANES III oral examination.

Edentulism was studied among persons 25 years and over; any untreated tooth decay and a recent dental visit, among dentate persons 18 years and over. Each study group covered the civilian, noninstitutionalized coterminous population of the United States during the 1988-1994 time period.

## Methods

**Source of Data:** NHANES III

### Study Populations:

- 13,040+ persons 25 years and over
- 13,400+ dentate persons 18 years and over

Appendix Table 1 (*in handout*) shows the gender, age, and racial-ethnic composition of the study populations.

### Measurement

Information on edentulism and any untreated (coronal or root) tooth decay was obtained through visual-tactile oral examinations carried out at mobile examination centers. The oral exams were conducted by licensed dentists who were trained and calibrated

to use standardized criteria in field studies.

Information on the interval since the last dental visit, as well as sociodemographic data on age, gender, race-ethnicity, and economic status, were obtained through individual and family-style interviews taken by trained and experienced field interviewers a week or two before the sample person's oral examination.

The economic status of families and unrelated individuals was measured by the ratio of the family's (or unrelated individual's) annual income to the dollar value of official poverty thresholds in effect for the year in which the person was examined.

For purposes of analysis, the ratio of annual (family) income to the poverty threshold was categorized in the following ways:

<i>Ratio of Annual Income To Poverty Threshold</i>	
<i>Category Definitions</i>	<i>Category Referred To As</i>
< 1.0	Poor
< .5	Very Poor
.5 - .9	Other ( <i>Remainder of the</i> ) Poor
1.0 or higher	Non-Poor
1.0 - 1.9	Near Poor
2.0 - 2.9	Lower Middle Income
3.0 - 3.9	Upper Middle Income
4.0 or higher	Higher Income

### Analytical Approach

The evaluation of whether, and to what extent,

poor/non-poor comparisons might be subject to certain kinds of information biases took place in three steps:

- (1) Estimates on each indicator were developed for the poor and then were compared to estimates for the non-poor, as well as to estimates for the near poor, persons in lower middle income families, persons in upper middle income families, and persons in families with still higher annual incomes.
- (2) The extent to which the poor/non-poor odds ratios under- or over-estimated the poor/specific non-poor income category odds ratios was described qualitatively in terms of the percentage of the latter odds ratio that was captured by the poor/non-poor odds ratio.
- (3) Estimates on each indicator next were developed for the very poor (viz, persons in families whose annual incomes were below 50 percent of the official poverty thresholds) and then were compared to the remainder of the poor (with annual incomes between 50 and 99 percent of the poverty threshold).

### Data Analysis

- Weighted data
- SUDAAN software (7.0)
- Proc DESCRIPT
- Proc LOGISTIC
- .01 level of significance used in evaluating all statistical results.

## RESULTS

### Edentulism

In the United States during 1988-1994, poor adults 25 years and over (17.3 percent) were 1.9 times more likely to be edentulous than non-poor adults (10.1 percent) were (Figure 1 and Table 1--attached). Among the poor, there was no difference between very poor (16.8 percent) and other poor adults (17.4 percent) with regard to edentulism (Figure 1--attached). But among the non-poor there was

considerable variability in the relative frequency of edentulism, ranging from 18.4 percent among the near poor to 4.2 percent among persons in higher income families.

Because of the diversity in edentulism among the non-poor, estimates of disparities between the poor and the non-poor with regard to the likelihood of edentulism differ considerably depending on the specific category of the non-poor with which the poor are compared. In the analyses which took age, gender and race-ethnicity into account, the likelihood of edentulism among the poor varied from 1.6 when non-poor persons in lower middle income families were the reference comparison group to 4.7 when persons in higher income families were the comparison group (bottom panel of Table 1--attached).

As a result, the odds ratios between the poor and the non-poor overestimate the odds ratios between the poor and the near poor (where the odds of edentulism actually are similar), as well as between the poor and the non-poor in lower middle income families (where the odds of edentulism actually are different)(Figure 2--attached). Oppositely, the odds ratios for the poor and the non-poor underestimate the odds ratios between the poor and persons in upper middle income families, as well as between the poor and persons in higher income families (Figure 2--attached).

### Any Untreated Tooth Decay In the Permanent Dentition

In the United States during 1988-1994, poor dentate adults 18 years and over (48.4 percent) were 2.7 times more likely to have any untreated tooth decay than non-poor dentate adults (25.9 percent) were (Figure 3 and Table 2--attached).

Among the poor, there was no difference between very poor (50.0 percent) and other poor adults (47.9 percent) with regard to having any untreated tooth decay (Figure 3--attached). But among the non-poor there was considerable variability in the relative

frequency of any untreated tooth decay ranging from 43.2 percent among the near poor to 14.2 percent among persons in higher income families.

Because of the diversity in any untreated tooth decay among the non-poor, estimates of disparities between the poor and the non-poor with regard to the likelihood of any untreated tooth decay differ considerably depending on the specific category of the non-poor with which the poor are compared. In the analyses which took age, gender and race-ethnicity into account, the likelihood of any untreated tooth decay among the poor varied from 2.1 when non-poor persons in lower middle income families were the reference comparison group to 5.4 when persons in higher income families were the comparison group (bottom panel of Table 2--attached).

As a result, the odds ratios between the poor and the non-poor overestimate the odds ratios between the poor and the near poor (where the odds of any untreated tooth decay actually are similar), as well as between the poor and the non-poor in lower middle income families (where the odds of any untreated tooth decay actually are different)(Figure 4--attached). Oppositely, the odds ratios for the poor and the non-poor underestimate the odds ratios between the poor and persons in upper middle income families, as well as between the poor and persons in higher income families (Figure 4--attached).

### A Recent Dental Visit

In the United States during 1988-1994, poor dentate adults 18 years and over (34.5 percent) were 2.6 times less likely to have visited a dentist or dental hygienist in the past 12 months than their non-poor counterparts (53.8 percent) were (Figure 5 and Table 3--attached).

Among the poor, there was no difference between very poor (33.6 percent) and other poor adults (34.8 percent) with regard to having a recent dental visit (Figure 5--attached). But among the non-poor there

was considerable variability in the relative frequency of having a recent dental visit, ranging from 42.0 percent among the near poor to 71.4 percent among persons in higher income families.

Because of the diversity in having a recent dental visit among the non-poor, estimates of disparities between the poor and the non-poor with regard to the likelihood of any untreated tooth decay differ considerably depending on the specific category of the non-poor with which the poor are compared. In the analyses which took age, gender and race-ethnicity into account, the likelihood of having a recent dental visit among the poor varied from 1.7 when non-poor persons in lower middle income families were the reference comparison group to 4.0 when persons in higher income families were the comparison group (*bottom panel of Table 3--attached*).

As a result, the odds ratios between the poor and the non-poor overestimate the odds ratios between the poor and the near poor (where the odds of having a recent dental visit actually are similar), as well as between the poor and the non-poor in lower middle income families (where the odds of having a recent dental visit actually are different)(*Figure 6--attached*). Oppositely, the odds ratios for the poor and the non-poor underestimate the odds ratios between the poor and persons in upper middle income families, as well as between the poor and persons in higher income families (*Figure 6--attached*).

## □ SUMMARY

This study has evaluated potential information biases in using poor/non-poor comparisons as sources of estimates of oral health inequalities. It has carried out this evaluation on three oral health characteristics--edentulism, any untreated tooth decay in the permanent dentition, and a recent dental visit--among all persons 25 years and over or dentate adults 18 years and over. It has controlled for age, gender, and racial-ethnic background. It has compared poor/non-poor comparisons with alternative comparisons

between the poor and more detailed subclassifications of the non-poor. It has utilized cross-sectional data obtained through NHANES III. The study findings may be summarized briefly in the following way.

In the United States during 1988-1994, among persons 25 years and over, the poor (17.3 percent) were 1.9 times more likely to be edentulous than were the non-poor (10.1 percent). During that same period, among dentate persons 18 years and over, the poor (48.4 percent) were 2.7 times more likely to have any untreated tooth decay than were the non-poor (25.9 percent). Conversely, poor dentate adults 18 years and over (34.5 percent) were 2.6 times less likely to have visited a dentist or dental hygienist in the past 12 months than were their non-poor counterparts (53.8 percent).

These unadjusted poor/non-poor odds ratios captured about 40, 47, and 54 percent, respectively, of the estimates for the largest unadjusted odds ratios between the poor and persons in families with annual incomes starting at four times the poverty thresholds. Compared to persons in these latter higher income families, the poor were 4.7 times more likely to be edentulous, 5.7 times more likely to have any untreated tooth decay, and 4.8 times less likely to have had a recent dental visit.

When the analyses controlled for age, gender, and racial-ethnic background, compared to the non-poor, the poor were 2.5 times more likely to be edentulous, 2.3 times more likely to have any untreated tooth decay, and were 1.5 times less likely to have had a recent dental visit. These adjusted poor/non-poor odds ratios captured only about 53, 43, and 38 percent, respectively, of the estimates for the largest adjusted odds ratios between the poor and persons in families with annual incomes starting at four times the poverty threshold. Compared to persons in these higher income families, the poor were 4.7 times more likely to be edentulous, 5.4 times more likely to have any untreated tooth decay, and 4.0 times less likely to have had a recent dental visit.

In a parallel fashion, by capturing, respectively, 86, 85, and 58 percent of the estimates of the odds ratios between the poor and persons in upper middle income families, the adjusted poor/non-poor odds ratios did considerably better for edentulism and any untreated decay, but not for a recent dental visit. Further, the observed adjusted poor/non-poor odds ratios were slightly higher than the adjusted poor/lower middle income odds ratios for edentulism and any untreated tooth decay, but slightly lower for a recent dental visit.

The adjusted analyses revealed that there were no differences between the poor and the near poor with regard to the likelihood of edentulism, any untreated decay, and a recent dental visit. Nor were there any differences among the poor in the likelihood of these characteristics between very poor and other poor adults.

## □ CONCLUSIONS

Poor/non-poor comparisons may be subject to information biases as sources of estimates of oral health inequalities. They may:

- overlook similarities between the poor and the near-poor,
- overestimate disparities between the poor and persons in lower middle income families, and
- underestimate disparities between the poor and persons in upper middle and higher income families.

Future research needs to clarify:

- whether these biases extend to other measures of oral health and oral health care for adults;
- whether these biases also occur when poor and non-poor children and adolescents are compared;
- whether these biases are replicated or affected in other ways when alternative ways of using ratio-of-income-to-poverty-threshold data are employed to classify the economic status of the population, or when such data are used in conjunction with educational attainment or

occupational data to classify the population in broader socioeconomic terms;

- whether biases in poor/non-poor comparisons of oral health characteristics also occur in the presence of additional controls, such as educational attainment and location of residence;
- whether differences between very poor and other poor persons (which did not occur in the present study) may occur for oral health characteristics or populations beyond the scope of this study; and
- whether there are biases in the estimates of oral health inequalities among persons entering, exiting, or remaining in poverty during a 12-month period, when the magnitude of surplus and deficit family incomes relative to the poverty threshold are ignored, or when the number and duration of poverty episodes, or persistence of poverty over many consecutive years, are not taken into account.

As this research proceeds, researchers should be cognizant that despite the usefulness of poor/non-poor comparisons in identifying aspects of oral health for which inequalities exist, poor/non-poor comparisons may be a source of information bias in studies of oral health inequalities when it comes to socially locating the extent of the disparities that exist.

- Accordingly, it is recommended that researchers utilize procedures that would minimize the effects of these kinds of biases, and whenever possible utilize procedures that would allow for further clarification of the amount and direction of these kinds of biases.

Finally, those responsible for the development, implementation, and evaluation of health and health care policies designed to reduce and eliminate health inequalities should be chary of poor/non-poor comparisons in that they may lead to false conclusions about the magnitude of the task that needs to be tackled, to inadequate resource allocations to achieve the goal of reducing and

eliminating inequalities, as well as to premature celebration of having eliminated disparities when efforts may have fallen far short of targetable objectives.

**Table 1. Estimates of The Likelihood of Edentulism Among Very Poor and Poor Persons 25 Years and Over: United States, 1988-1994**

Model	<i>Persons 25 Years and Over</i>					
	<b>Likelihood of Edentulism</b>					
	<b>Among the Very Poor Compared to Other Poor</b>	<i>Among All of the Poor Compared to the Non-Poor</i>				
		<b>All Non-Poor</b>	<b>Near Poor</b>	<b>Lower Mid. Inc.</b>	<b>Upper Mid. Inc.</b>	<b>Higher Income</b>
	<i>Unadjusted Estimates</i>					
<b>Odds Ratios</b>	1.0	1.9	0.92	1.4	2.5	4.7
<b>99% Confidence Intervals</b>	0.64-1.4	1.4-2.4	0.73-1.2	1.0-1.9	1.7-3.6	3.5-6.5
<b>P-Values</b>	.7580	.0000	.3468	.0068	.0000	.0000
	<i>Estimates Adjusted for Gender, Age and Race-Ethnicity</i>					
<b>Odds Ratios</b>	1.5	2.5	1.3	1.6	2.9	4.7
<b>99% Confidence Intervals</b>	0.9-2.6	1.8-3.3	1.0-1.6	1.2-2.3	1.9-4.3	3.5-6.5
<b>P-Values</b>	.0599	.0000	.0209	.0003	.0000	.0000

**Source: NHANES III.**

**Table 2. Estimates of The Likelihood of Any Untreated Tooth Decay Among Very Poor and Poor Dentate Persons 18 Years and Over: United States, 1988-1994**

Model	Dentate Persons 18 Years and Over					
	Likelihood of Any Untreated Tooth Decay					
	Among the Very Poor Compared to Other Poor	Among all of the Poor Compared to the Non-Poor				
		Non-Poor				
	All Non-Poor	Near Poor	Lower Mid. Inc.	Upper Mid. Inc.	Higher Income	
	<i>Unadjusted Estimates</i>					
<b>Odds Ratios</b>	1.1	2.7	1.2	2.2	2.9	5.7
<b>99% Confidence Intervals</b>	0.7-1.8	2.1-3.4	0.9-1.6	1.7-2.8	2.2-3.9	4.3-7.6
<b>P-Values</b>	.6492	.0000	.0554	.0000	.0000	.0000
	<i>Estimates Adjusted for Gender, Age and Race-Ethnicity</i>					
<b>Odds Ratios</b>	1.0	2.3	1.2	2.1	2.7	5.4
<b>99% Confidence Intervals</b>	0.6-1.7	1.8-3.0	0.9-1.5	1.6-2.6	2.0-3.6	4.0-7.3
<b>P-Values</b>	.8593	.0000	.1297	.0000	.0000	.0000

**Source: NHANES III.**

**Table 3. Estimates of The Likelihood of A Recent Dental Visit Among Very Poor and Poor Dentate Persons 18 Years and Over: United States, 1988-1994**

Model	<i>Dentate Persons 18 Years and Over</i>					
	<b>Likelihood of A Recent Dental Visit</b>					
	<b>Among the Very Poor Compared to Other Poor</b>	<i>Among All of the Poor Compared to the Non-Poor</i>				
		<b>All Non-Poor</b>	<b>Near Poor</b>	<b>Lower Mid. Inc.</b>	<b>Upper Mid. Inc.</b>	<b>Higher Income</b>
	<i>Unadjusted Estimates</i>					
<b>Odds Ratios<sup>a</sup></b>	1.1	2.6	1.4	1.9	2.9	4.8
<b>99% Confidence Intervals<sup>a</sup></b>	0.6-1.7	2.1-3.2	1.1-1.7	1.5-2.3	2.2-4.0	3.3-6.7
<b>P-Values</b>	.7983	.0000	.0010	.0000	.0000	.0000
	<i>Estimates Adjusted for Gender, Age and Race-Ethnicity</i>					
<b>Odds Ratios<sup>a</sup></b>	1.0	1.5	1.3	1.7	2.6	4.0
<b>99% Confidence Intervals<sup>a</sup></b>	0.6-1.6	1.7-2.7	1.0-1.6	1.4-2.1	1.9-3.6	2.9-5.9
<b>P-Values</b>	.8868	.0000	.0153	.0000	.0000	.0000

Source: NHANES III.

<sup>a</sup>Odds ratios and confidence intervals have all been reflected and should be interpreted as so many times less likely than the reference groups to have had a recent dental visit.